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ABSTRACT

The structure of the vocational interests of Taiwanese high school students was examined by using three models of occupational interest: Holland's hexagonal model; Gati's hexagonal model; and Rounds and Tracy's three-class partition model. A two-stage cluster sampling procedure was used to select the study participants. After 2 high schools had been randomly selected in each of Taiwan's 22 counties, 1 class in each of the 44 high schools was randomly sampled. A total of 1,861 students (788 males and 1,073 females) who planned to enter a college/university were selected to complete the Chinese Vocational Interest Inventory, which is based on Holland's six-scale typology of occupational choice. Within the study sample, most boys had realistic and investigative interests whereas most girls had artistic and investigative interests. Analysis of the Taiwanese student's responses considered the unique features of Taiwanese culture and was based on multidimensional scaling and the technique of order prediction. The analysis established that Gati's hierarchical model of vocational interest, which organizes Holland's six types of vocational interests into three clusters (realistic-investigative, artistic-social, and enterprising-conventional), is best for interpreting the vocational interest structure of Taiwanese high school students. (Contains 32 references) (MN)

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Running head: INTEREST MODELS

The Vocational Interest Structure of Taiwanese High School Students

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ABSTRACT

The purpose of the study was to test Holland's(1985) hexagonal model in a Chinese culture. The fit of the hexagonal model, Gati's(1982) hierarchical model, and Rounds and Tracy's(1993) three-class partition were also evaluated based on the sample of 1861 high school students (788 boys and 1073 girls). The instrument used in this study was the *Chinese Vocational Interest Inventory* developed by Tien(1993). The ALSCAL solutions of multidimensional scaling verified the order of RIASEC for females. While for males, the ordering of the six interest types on the two-dimensional space was IRASEC. With regard to the fit of the three models, the results of randomization test indicated Gati's hierarchical model the best to interpret the vocational interest structure of Taiwanese high school students.

The Vocational Interest Structure of Taiwanese High School Students

Over the past few decades, several models of vocational interest structure have been proposed. The well-known models include the two-dimensional model of American College Test World of Work Map (Prediger, 1976), Holland's (1976,1985) hexagonal model, Roe's (1954) eight-category circular model, Kuder's (1977) ten categories of vocational interests, Jackson's (1977) eight work style preferences and twenty-six work role preferences, and Gati's (1979) hierarchical model. In addition to these models, Rounds and Tracy (1993) proposed a three-partition groups of vocational interest structure. This model is new and more research studies are needed to test its construct validity.

Of all the models, Holland's model is widely used in counseling practice in the United States because of its simplicity and applicability. He assumed that there are six personality types: Realistic(R), Investigative(I), Artistic(A), Social(S), Enterprising(E), and Conventional(C). The six types could be arranged as a hexagon on the two-dimensional space according to their resemblance to one another. Gati (1979) questioned the hexagonal model and proposed another system to organize the six types of vocational interests. The model proposed by him is a hierarchical model with three clusters of interests at the bottom of the model: RI, AS, and EC. In this hierarchical model, the correlations within clusters should be greater than the correlations between the other pairs of types from different clusters. Rounds and Tracy(1993) further proposed another three-partition model similar to Gati's except for that A is in one group by itself and S, E, and C in one group. The applicability of the three models based on the six interest types were compared in this study.

Career counseling is more and more important for high schqol students in Taiwan. For students in the United States, they choose their majors after they get into the colleges. However,

for the students in Taiwan, high school students have to choose either Social Science or Natural Science as their focused area to prepare for entering into the college. Moreover, they have to choose major, or department, before they enter the college. From this viewpoint, the high school students need more services in understanding themselves in order to choose a right major for them when they choose to enter the college.

The purposes of the study was to explore the Taiwanese high school students' vocational interest structure. Holland's hexagonal model, Gati's hierarchical model, and Rounds and Tracy's (1993) three-class partition model were compared to see which one is better in interpreting the high school students' interest structure in Taiwan.

METHOD

Participants

A two-stage cluster sampling procedure was used to select the participants. Two high schools in each of the 22 counties in Taiwan were randomly selected first. One class in each of the 44 high schools were then randomly sampled. There were total 1861 students (788 males and 1073 females) who answered the questionnaires. All of the students are preparing for entering the universities or colleges.

Instrument

The instrument used in the study was the Chinese Vocational Interest Inventory (Tien, 1993). It is a forced-choice format inventory with 120 questions in activities section and 60 questions in occupations section, totaling 180. The inventory, which was constructed in Chinese based on Holland's(1985) typology, includes six scales: Realistic, Investigative, Artistic, Social,

Enterprising, and Conventional. The estimated reliability coefficients of the six scales range from .66 to .94 for the male and range from .68 to .90 for the female.

As far as the criterion validity, the percentage of hits, using the current college major as the criterion variable, is 45.9% for males and 50.5% for females, which is considered an excellent hit rate according to the criterion set by Hansen and Campbell (1985). The results of convergent-discriminant validity tested by using the Multi-Trait Multi-Method (MTMM) indicated that the convergent coefficients were in general greater than the discriminant coefficients. These data support the validity of the Chinese Vocational Interest Inventory. The data for reliability and validity tests were based on the sample of 831 Taiwanese college students, composed of 366 males and 465 females (Tien, 1993).

Data Analysis

Multidimensional scaling (MDS) was conducted to examine Holland's model of vocational interest structure; the method order prediction was employed to compare Holland's hexagonal, Gati's hierarchical model, and Rounds and Tracy's three-class partition.

Multidimensional scaling(MDS)

MDS is designed to analyze distance-like data that indicate the degree of dissimilarity (or similarity) of two objects. It has its origins in psychometrics where it was proposed to help understand people's judgments of the similarity of members of a set of objects.

Davison (1985) compared MDS to factor analysis and suggested that the MDS is a more parsimonious solution than the factor analysis is. MDS can often represent the structure on fewer dimensions than can factor analysis although both can be used to study the structure of objects. Guilford (1952) identified some common faults in the use of factor analysis. He criticized correlation coefficients used in factor analysis as often spurious, especially in the case of ipsative

scales. He asserted that correlations of ipsative scores should not be factor analyzed. In this study, the ipsative scales were used in the Chinese Vocational Interest Inventory and the correlation matrix can not be analyzed by the confirmatory factor analysis. However, MDS was used to analyze the underlying structure of the college students' vocational interests in Taiwan.

The classical nonmetric MDS was used in this study to examine the relationship among the six vocational interest types proposed by Holland in a two dimensional space. The Euclidean distance among the six interest types were first calculated and then used by the MDS to create the stimulus coordinates for the six interest types. The locations of the six interest types were then indicated on the two-dimensional space according to the stimulus coordinates.

According to Fouad and Dancer (1992), the fit of an MDS solution to an observed matrix typically can be assessed by one of two inverse measures of goodness-of-fit, the coefficient of alienation (COA; Guttman, 1968) or Kruskal's (1964) stress Formula One. Large values of either index indicated that the specified number of dimensions inadequately accommodates the observed relations among the variables and suggests the need for a solution space of higher dimensionality. Near zero values of either index indicate a good fit of the MDS solution to the observed data. Kruskal (1964) offered guidelines as to what "good" stress values should be in the typical nonmetric application: .20=poor, .10=fair, .05=good, .025=excellent, and 0.0=perfect. In this study, Kruskal's stress Formula One was used as the index of goodness of fit. RSQ, the squared correlation between the data and the distances, is an additional index to examine the fit of the model to the observed data. It can be interpreted as the proportion of variance of the transformed data that is accounted for by the distances of the MDS model. It was also used in this study.

Order predictions of the three interest models

The spatial analysis proposed by Wakefield and Doughtie (1973) involves 54 independent distance comparisons for Holland's model, However, Hubert and Arabie (1987) claimed that there should be 72 comparisons for Holland's model and 36 comparisons for Gati's hierarchical model. Of those comparisons, 27 are common to both hexagonal and hierarchical models, 45 are unique to Holland's model, and 9 of them are unique to Gati's model.

Hubert and Arabie (1987) also proposed an index of correspondence to examine the fitness of both hexagonal and hierarchical models. The index describe the correspondence between the hypothesized order relations and the observed order relations within a correlation matrix. This index can also be used to compare the hypothesized order fit between models. The index is of the form (Hubert & Arabie, 1987, p. 176):

$$(A - D) / (A + D + T)$$

where A is the number of order predictions met (agreements), D is the number of violations of the order predictions (disagreements), and T is the number of ties. The denominator is actually the total number of order predictions.

RESULTS

Means and standard deviations of the six interest scales on the Chinese Vocational Interest Inventory are presented in Table 1. These data were based on 788 boys and 1073 girls. Within the present sample, high school boys prefer realistic and investigative types of interest, while the girls prefer artistic and investigative types of interest.

Insert Table 1 about here

The results of multidimensional scaling

Table 2 shows the ALSCAL solutions for the boys and girls data obtained from the Chinese Vocational Interest Inventory. Those stimulus coordinates identify the locations of the six vocational interest types on a two dimensional space.

Insert Table 2 about here

Figure 1 presents the two-dimensional configuration for boys data obtained from the Chinese Vocational Interest Inventory. The stress value is .07 and the RSQ is .99. Figure 2 is the two-dimensional configuration for the structure of the Chinese Vocational Interest Inventory based on the sample of 1073 girls. The stress value is 0.13 and the RSQ is .91. According to the criterion proposed by Kruskal (1964), the stress values .07 and .13 are good and acceptable. It means that the configurations presented in Figure 1 and Figure 2 fit the data collected in this study.

Insert Figure 1 and Figure 2 about here

The results of order prediction

The intercorrelations among the six interest types are listed in Table 3, with boys data below the diagonal and girls data above the diagonal. Based on these intercorrelations, Table 4 indicates the results of order predictions for the three models. According to Rounds and Tracy (1996), Holland's hexagonal model yields 72 order predictions, Gati's hierarchical model generates 36 order predictions, and their three-class partition group yields 44 order predictions.

Insert Table 3 and Table 4 about here

As shown in Table 4, for Holland's model, 44 of the 72 order predictions were met within the male's correlation matrix. The correspondence index is (44-28)/72=.22. For the female sample, 42 of the 72 predictions were met. The correspondence is (42-30)/72=.17.

In the order prediction of Gati's model, for the male sample there was no violation, and the correspondence index is (36-0)/36=1.00. For the female sample, there are three violations occurred. The correspondence index is (33-3)/36=.83.

For Rounds and Tracy's three-class partition model, 39 of the 44 order predictions were met for males and the correspondence index is (39-5)/44=.77; however, for females, 40 out of the 44 comparisons were met and the correspondence index is (40-4)/44=.82.

The correspondence indices for the three models are listed in Table 5. Generally speaking, Gati's hierarchical model seemed to be the best model of the three models proposed for this study in terms of its fitness to the data collected in Taiwan.

Insert Table 5 about here

DISCUSSION

Generalizability of Holland's model for Taiwanese high school students

Holland proposed the six interest types and believed that the relationships among the six types can be arranged to a hexagon on a two dimensional space according to their resemblance to each other. The results of the study for females data supported the order of R-I-A-S-E-C, which is similar to the results of a similar study conducted several years ago (Tien, 1993) with college females as the sample. However, for the males in this study, the order of the six types on the two dimensional space was I-R-A-S-E-C. Although the order of the six types was not the same as proposed by Holland, the two types I and R were close to each other while A, S, E, and C were far away on the other end of the figure. This finding corresponds to Gati's suggestions of hard science and soft science.

Comparisons of the applicability of the three interest structure models

Gati conducted a series of studies (1979, 1982, 1991a) and claimed that his hierarchical model is superior to Holland's hexagonal model. However, Rounds and Tracy (1992) reanalyzed 104 published matrices based on Holland's six interest types and concluded that Holland's hexagonal model was superior to Gati's hierarchical model in representing the structure of the six interest types RIASEC. According to the correspondent indices listed in Table 5, Gati's model seems to be the most adequate model in interpreting the interest structure of Taiwanese high school students. If we further examine the correspondent indices in Rounds and Tracy's study

(1992), for the 26 of the 104 matrices from non-American cultures (i.e. Australia, Guyana, Taiwan, New Zealand, and Mexico), the correspondent index for Gait' model was greater than that of Holland's model (Rounds & Tracy, 1992, P34). Results of the present study confirmed this finding. Gati's model seems to be superior in interpreting the students' interest structure for non-American cultures.

In Taiwan, the high school students have to choose either natural science or social science as their focused area in order to prepare for the College Entrance Examination, which is classified into four categories. The students who choose social science as the focused area attend the first category of the exam, which includes majors in college of arts education, business, and political science. Those who choose natural science as their focused area can choose to attend one or more of the other three categories of the entrance exam and the college majors for them would be from the colleges of engineering, medicine, or science. This kind of classification system seems correspond to Gati's idea of natural science and social science on the top of the hierarchical model. This is part of the reason why the results of order prediction supported Gati's model in this study. As far as the lower part of the hierarchical model, further studies need to be conducted.

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Table 1

Means and standard deviations of the six interest scales for the 788 boys and 1073 girls

		R	I	A	S	E	C
Boys	M	33.73	32.86	23.18	20.95	17.48	13.30
(n=788)	SD	10.17	11.38	6.02	4.21	3.78	4.52
	Preference	1	2	3	4	5	6
Girls	M	19.67	22.15	22.66	20.40	16.04	12.99
(n=1073)	SD	9.24	11.20	6.40	4.02	3.93	4.67
	Preference	4	2	1	3	5	6

Table 2

Two-dimensional ALSCAL solutions for the Chinese Vocational Interest Inventory

	Boys (N=784)		Girls (N=1073)	
Scale	Dimension 1	Dimension 2	Dimension 1	Dimension 2
Realistic	1.8257	-.6695	.8230	-1.2158
Investigative	1.7036	.8601	1.8962	-.0529
Artistic	-.2699	-.4912	.0111	1.4268
Social	-.5434	-.0516	-.2351	.6757
Enterprising	-1.0319	.1518	-.9887	-.1891
Conventional	-1.6842	.2004	-1.5065	-.6447

Table 4

Order predictions of the three models based on the sample of 784 boys and 1073 girls

	RI	RA	RS	RE	RC	IA	IS	IE	IC	AS	AE	AC	SE	SC	EC
RI	-	g 1	g 1	g 1	g 1	g 1	g 1	g 1	g 1	g?	g 0	g 0	g 0	g 1	g?
	-	h 1	h 1	h 1	h?	h?	h 1	h 1	h 1	h?	h 1	h 1	h?	h 1	h?
	-	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a?	a?	a?
RA	g 1	-	g?	g?	g?	g?	g?	g?	g?	g 1	g?	g?	g?	g?	g 1
	h 1	-	h 0	h?	h 1	h 1	h?	h 0	h?	h 1	h?	h 0	h 1	h?	h 1
	a 1	-	a?	a?	a?	a?	a?	a?	a?	a?	a?	a?	a 1	a 1	a 1
RS	g 1	g?	-	g?	g?	g?	g?	g?	g?	g 1	g?	g?	g?	g?	g 1
	h 1	h 0	-	h 0	h 0	h 0	h 1	h?	h 1	h 1	h 1	h?	h 1	h 1	h 1
	a 1	a?	-	a?	a?	a?	a?	a?	a?	a?	a?	a?	a 1	a 1	a 1
RE	g 1	g?	g?	-	g?	g?	g?	g?	g?	g 1	g?	g?	g?	g?	g 1
	h 1	h?	h 0	-	h 0	h 0	h?	h 0	h?	h 1	h?	h 0	h 1	h?	h 1
	a 1	a?	a?	-	a?	a?	a?	a?	a?	a?	a?	a?	a 1	a 1	a 1
RC	g 1	g?	g?	g?	-	g?	g?	g?	g?	g 1	g?	g?	g?	g?	g 1
	h?	h 0	h 0	h 0	-	h?	h 0	h 0	h 0	h?	h 0	h 0	h?	h 0	h?
	a 1	a?	a?	a?	-	a?	a?	a?	a?	a?	a?	a?	a 1	a 1	a 1
IA	g 1	g?	g?	g?	g?	-	g?	g?	g?	g 1	g?	g?	g?	g?	g 1
	h?	h 1	h 0	h 1	h?	-	h 0	h 0	h 0	h?	h 0	h 0	h?	h 0	h?
	a 1	a?	a?	a?	a?	-	a?	a?	a?	a?	a?	a?	a 1	a 1	a 1
IS	g 1	g?	g?	g?	g?	g?	-	g?	g?	g 1	g?	g?	g?	g?	g 1
	h 1	h?	h 1	h?	h 0	h 0	-	h 1	h?	h 1	h?	h 0	h 1	h?	h 1
	a 1	a?	a?	a?	a?	a?	-	a?	a?	a?	a?	a?	a 1	a 1	a 1
IE	g 1	g?	g?	g?	g?	g?	g?	-	g?	g 1	g?	g?	g?	g?	g 1
	h 1	h 0	h?	h 0	h 0	h 0	h 0	-	h 0	h 1	h 1	h?	h 1	h 1	h 1
	a 1	a?	a?	a?	a?	a?	a?	-	a?	a?	a?	a?	a 1	a 1	a 1
IC	g 1	g?	g?	g?	g?	g?	g?	g?	-	g 1	g?	g?	g?	g?	g 1
	h 1	h?	h 0	h?	h 0	h 1	h?	h 0	-	h 1	h?	h 0	h 1	h?	h1
	a 1	a?	a?	a?	a?	a?	a?	a?	-	a?	a?	a?	a 1	a 1	a1
AS	g?	g 1	g 1	g 1	g 1	g 1	g 1	g 1	g 1	-	g 1	g 1	g 1	g 1	g?
	h?	h 1	h 1	h 1	h?	h?	h 1	h 1	h 1	-	h 0	h 0	h?	h 1	h?
	a 0	a?	a?	a?	a?	a?	a?	a?	a?	-	a?	a?	a 1	a 0	a1
AE	g 1	g?	g?	g?	g?	g?	g?	g?	g?	g 1	-	g?	g?	g?	g 1
	h 1	h?	h 1	h?	h 0	h 0	h?	h 1	h?	h 1	-	h 0	h 1	h?	h 1
	a 1	a?	a?	a?	a?	a?	a?	a?	a?	a?	-	a?	a 1	a 0	a 1
AC	g 1	g?	g?	g?	g?	g?	g?	g?	g?	g 1	g?	-	g?	g?	g 1
	h 1	h 0	h?	h 0	h 0	h 0	h 0	h?	h 0	h 1	h 0	-	h 0	h 0	h 1
	a 1	a?	a?	a?	a?	a?	a?	a?	a?	a?	a?	-	a 0	a 0	a 1
SE	g 1	g?	g?	g?	g?	g?	g?	g?	g?	g 1	g?	g?	-	g?	g 1
	h?	h 1	h 1	h 1	h?	h?	h 1	h 1	h 1	h?	h 1	h 1	-	h 1	h?
	a?	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 0	a 1	a 1	-	a?	a?
SC	g 1	g?	g?	g?	g?	g?	g?	g?	g?	g 1	g?	g?	g?	-	g 1
	h 1	h?	h 1	h?	h 0	h 0	h?	h 1	h?	h 1	h?	h 0	h 1	-	h 1
	a?	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 0	a 0	a 0	a?	-	a?
EC	g?	g 1	g 1	g 1	g 1	g 1	g 1	g 1	g 1	g?	g 1	g 1	g 1	g 1	-
	h?	h 1	h 1	h 1	h?	h?	h 1	h 1	h 1	h?	h 1	h 1	h?	h 1	-
	a?	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a 1	a?	a?	-

Note. Order predictions below the diagonal are for boys and above the diagonal are for girls. The value "1" indicates correspondence of prediction, "0" indicates violation of prediction, and "?" indicates no prediction made. g= Gati prediction, h= Holland prediction, and a= Rounds and Tracy prediction.

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Table 3

Intercorrelations among the six interest scales on the Chinese Vocational Interest Inventory

	R	I	A	S	E	C
Realistic		5973	1853	3328	2838	2459
Investigative	5389		2711	4285	4172	3569
Artistic	1729	2865		5121	5146	5324
Social	2947	3800	5435		5202	4978
Enterprising	2685	4339	5150	5251		6919
Conventional	1234	2682	5211	5031	6520	

Note. Values below the diagonal are for boys and values above the diagonal are for girls. Decimal omitted.

Table 5

Correspondence Index for the three models of vocational interest structure

Models	Boys (n=788)	Girls (n=1073)
Holland	.22	.17
Gati	1.00	.83
Rounds & Tracy	.77	.82

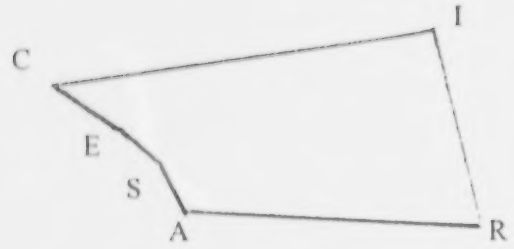

Figure 1. Two-dimensional configuration for the Chinese Vocational Interest Inventory based on the sample of 788 male college students. (stress=.07 and RSQ=.99)

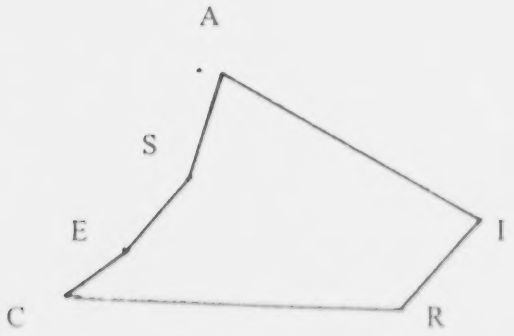

Figure 2. Two-dimensional configuration for the Chinese Vocational Interest Inventory based on the sample of 1073 female high school students. (stress=.13 and RSQ=.91)